KRAMES

CARDIAC RESYNCHRONIZATION THERAPY (CRT)

Biventricular Pacemaker or ICD

What Is CRT?

When you have **heart failure,** your heart muscle is weakened and doesn't pump as well as it should. As a result, the body doesn't get enough blood and oxygen. This can lead to symptoms, such as low energy and shortness of breath, that can put limits on your life. **CRT (cardiac resynchronization therapy)** is a treatment that can help. It involves putting a small device under your skin to manage your heartbeat. For many people with heart failure, CRT reduces symptoms and improves quality of life.

Benefits of CRT

CRT helps a weakened heart pump more efficiently with each beat. This may help you:

- Return to daily activities such as walking, doing chores, and climbing stairs.
- Have more energy to be active and do the things you enjoy.
- Breathe more easily when lying down, so you sleep better at night.
- Have less swelling in your ankles, feet, and abdomen.
- Make fewer visits to the hospital due to heart failure symptoms.
- Have fewer side effects from your heart failure medications.

Two Devices to Help Your Heart

For CRT, one of two devices can be used. You and your doctor will discuss which one is best for you.

- A **biventricular pacemaker** sends signals to pace the heart, helping it beat on time. This helps the heart pump blood more efficiently with each beat.
- A **biventricular ICD** (implantable cardioverter defibrillator) also paces the heart to help it pump more efficiently. In addition, this device can stop a life-threatening heart rhythm (when the heart beats much too fast).

CRT is also called **biventricular pacing.**

Your Role

CRT doesn't replace your other treatments. Rather, it's part of a complete heart failure treatment plan. Talk with your doctor about how CRT fits into your plan and what it can do for you. Any procedure has risks, so be clear about what the risks are for you. Also talk about the benefits of CRT. Know what other options you have. In addition, be sure to mention any concerns and get answers to questions you have. By being involved and informed about your treatment, you can help your doctor ensure you get the care you need.

Risks and Complications

The risks and possible complications of implantation include:

- **Bleeding**
- **Infection**
- **Severe bruising or swelling at the incision site**
- **Puncture of the lung or heart muscle**
- **Tearing of the vein or artery wall**
- **Need to have leads or generator replaced**
- **Heart attack, stroke, or death (very rare)**

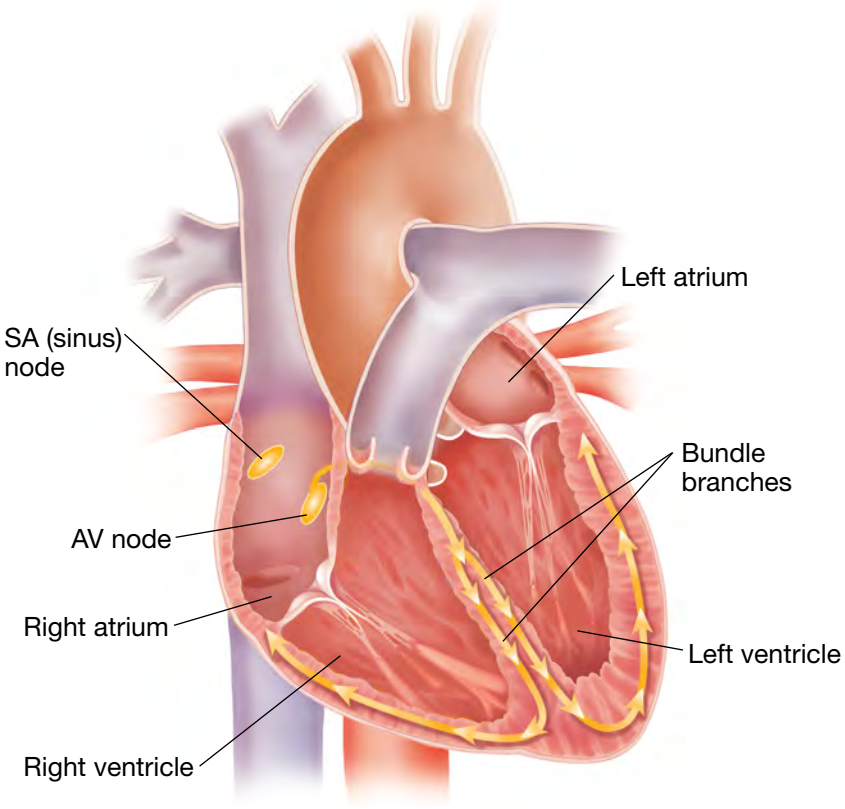
How the Heart Works

The heart is a strong muscle that pumps blood throughout the body. This muscle contracts and relaxes (beats) many times a minute. The speed and pattern at which the heart beats is the heart rhythm. Signals from the heart's electrical system control this rhythm, telling the heart when to contract and relax.

A Healthy Heart

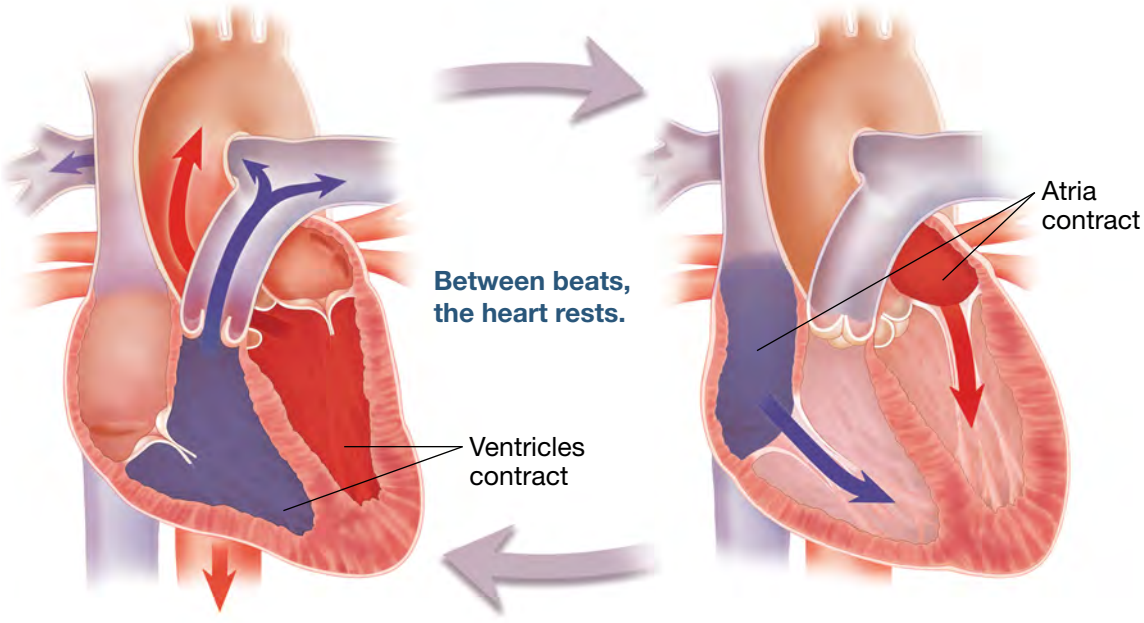
The walls of the heart are made of strong muscle. These walls **contract** (squeeze) to pump blood into and out of the heart. In a healthy heart:

- **Four chambers** hold the blood as it moves through the heart. The upper chambers are the **right atrium** and the **left atrium.** The lower chambers are the **right ventricle** and the **left ventricle.**
- **Groups of electrical cells** create electrical signals that tell the heart when to contract and relax. These signals start in the **nodes.** The signals travel through the heart walls along pathways of electrical cells (called the **bundle branches**).



How the Heart Pumps Blood

As the heart beats, blood moves through the chambers and out to the body. Oxygen-poor blood (shown with blue arrows) goes through the right side of the heart, to the lungs. Oxygen-rich blood (red arrows) goes through the left side of the heart, to all other parts of the body. The heart muscle must pump enough blood to keep the body healthy. Each heartbeat has two steps:



The ventricles contract: As the atria (upper chambers) relax and fill with blood entering the heart, the ventricles (lower chambers) squeeze. This pumps blood out of the heart, to the lungs and the body. With the next heartbeat, the process begins again.

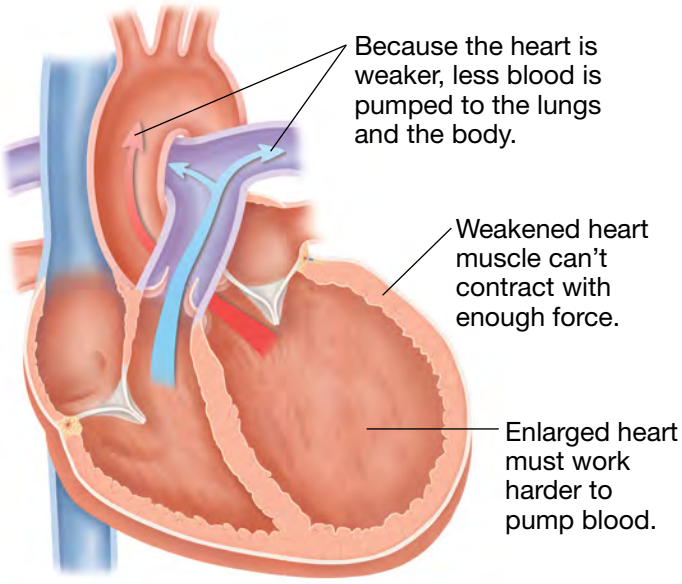
The atria contract: As the atria squeeze to send blood into the ventricles, the ventricles relax to receive this blood.

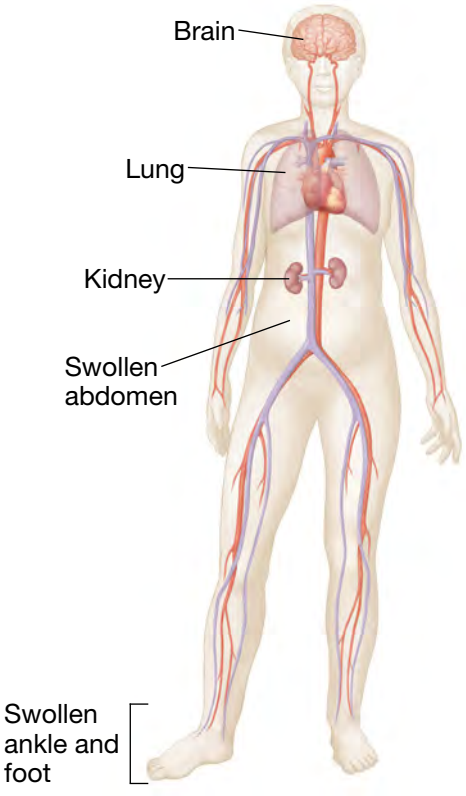
The Heart's Electrical System

Electrical signals from cells in the heart tell each of the heart's chambers when to contract. These signals travel smoothly through healthy muscle. They keep the heart's contractions **synchronized** (timed correctly). When contractions are synchronized, a healthy amount of blood can be pumped from the heart to the lungs and the rest of the body.

When Heart Failure Occurs

With heart failure, the heart muscle, especially the left ventricle, stretches and weakens. The weakened muscle can't pump as much blood as it should with each beat. This causes the symptoms you feel. Heart failure can also cause problems with the heart's electrical signals. Some people have electrical problems even before heart failure develops. Heart failure makes these problems worse.



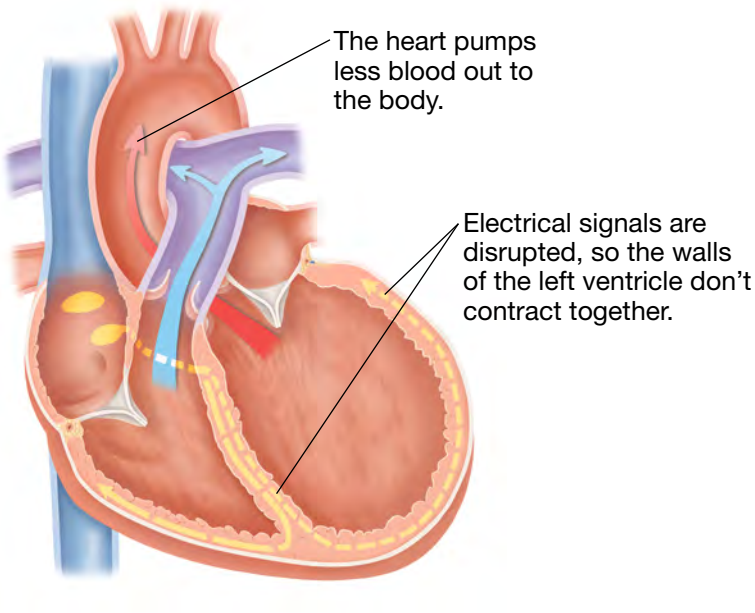


Problems with the Pump

With heart failure, the muscle is too weak to pump enough blood forward when the ventricles contract. Less blood travels to the lungs and the rest of the body with each heartbeat. When the heart pumps less blood, less blood flows to organs like the brain. So they don't work as well. You may feel dizzy or confused. Also, when the heart isn't moving blood as it should, extra fluid starts to build up in the body. The fluid may collect in your legs and feet or pool in your abdomen, causing swelling. Your lungs may fill with fluid, making you short of breath.

Problems with Electrical Signals

Electrical signals may not travel as well through a heart with heart failure. Often, this results in the walls of the left ventricle not contracting together as they should. When they are out of sync, the heart pumps even less blood to the body. This makes heart failure symptoms worse. In some cases, damaged electrical cells send extra signals. These can make the heart beat so fast it can be fatal.



Ejection Fraction

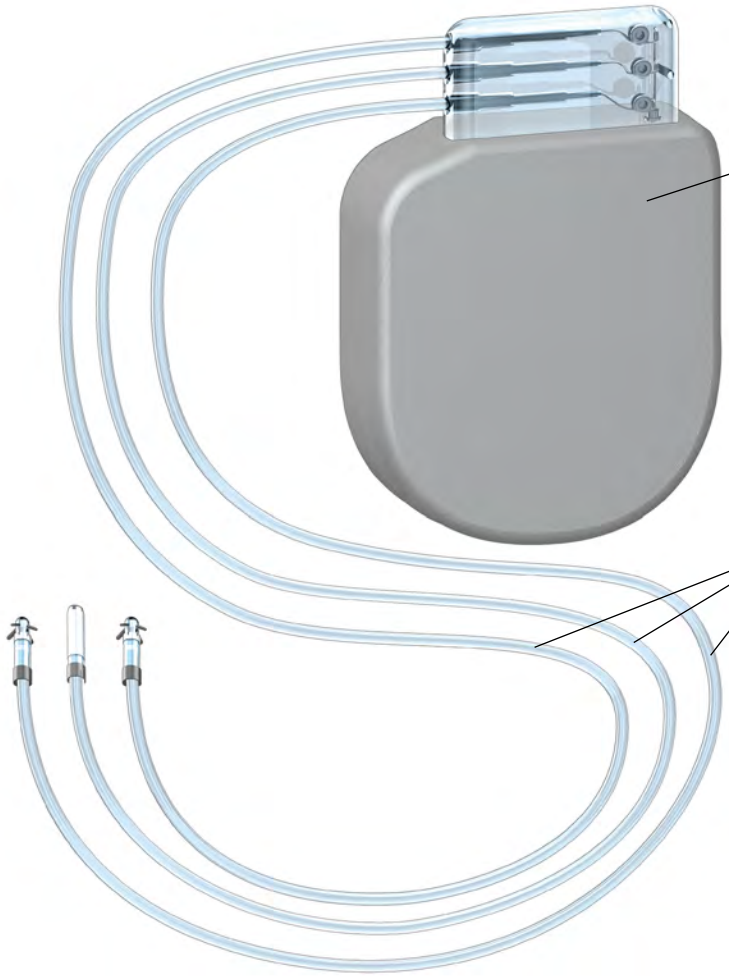
Ejection fraction (EF) is a measure of the blood that the heart pumps out. This typically refers to how much of the total blood in the left ventricle is pumped out with each beat. A normal EF is between 55% and 70%.

How CRT Works

The goal of CRT is to make the walls of the ventricles contract together again. This is called resynchronization. To do this, a small medical device is connected to your heart. The device sends electrical signals to the ventricle walls. This makes them contract at the same time and makes the heart more efficient.

The Device

Depending on your heart's needs, you will receive a biventricular pacemaker or a biventricular ICD. Both ensure that the contractions of the heart's chambers are timed correctly. A biventricular ICD can also stop a dangerously fast heart rhythm.



The generator is a smooth, lightweight metal case containing a tiny computer and a battery. The generator monitors the heart rate and sends out electrical impulses.

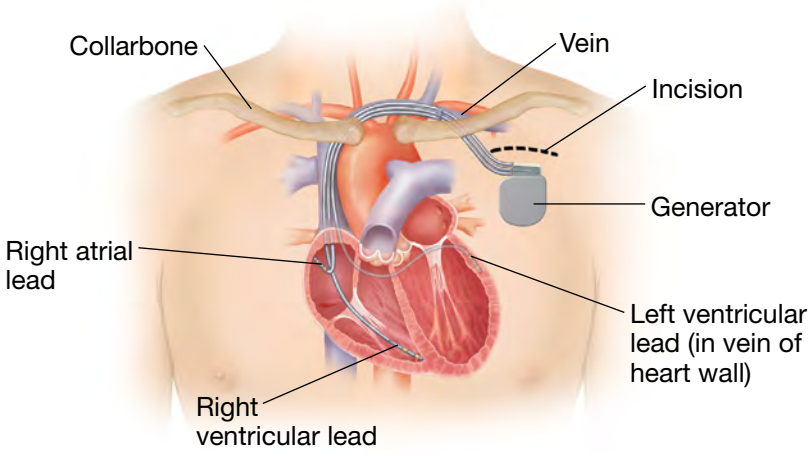
The leads are wires covered by a soft, flexible material. Most biventricular pacemakers and ICDs have three leads. The leads carry electrical signals between the generator and the heart.

In rare cases, a procedure called **epicardial implantation** is needed. If this procedure is best for you, your doctor can tell you more.

Putting the Device into the Body

The device is placed in your body during a process called **implantation.** Here's how it's done:

- **An incision is made** beneath the collarbone. A small "pocket" for the generator is created between skin and muscle. In most cases, this is on the left side of the chest, below the collarbone.
- **A lead is guided through a vein** into your heart. A real-time x-ray video helps your doctor guide the lead into place. This is repeated for each lead.
- **The lead or leads are attached to the heart muscle** using small anchors on the tips of the leads.
- **The generator is attached to the leads** and put in the pocket under your skin.
- **A fast heart rhythm may be induced and stopped** to test the device.
- **The incision is closed.** You're then taken to a recovery area.



Two Types of Devices

- **Biventricular pacemakers** ensure that contractions of the heart's chambers are timed correctly. In most cases, one lead senses the heart's electrical signals in the right atrium. Based on the timing of these signals, the other two leads send electrical impulses to the right and left ventricles. These impulses synchronize the chambers' contractions. So, blood is pumped out of the heart more efficiently.
- **Biventricular ICDs** stop dangerously fast heart rhythms that can develop in damaged heart muscle. Like a biventricular pacemaker, an ICD sends electrical impulses to synchronize the right and left ventricles. The ICD can also interrupt a too-fast heart rhythm, returning the heartbeat to normal.

Before and After the Procedure

Implantation of a biventricular pacemaker or ICD takes 1 to 4 hours. You will likely stay overnight in the hospital after the procedure. Follow all instructions you are given for getting ready for the procedure and recovering afterward.

Getting Ready for the Procedure

- Have tests that your doctor recommends.
- Tell your doctor about all prescribed medications you take. Be sure to mention medications to prevent blood clots. These include daily aspirin and drugs such as warfarin. Also mention if you take diabetes medications such as insulin. You may be given special instructions for these.
- Also tell your doctor about all over-the-counter medications, herbal remedies, or supplements you use. Mention if you take pain relievers, such as NSAIDs.
- Don't eat or drink anything as instructed before your procedure. If you need to take medications, swallow them with a small sip of water.

Before Implantation

- You will be asked your name and procedure more than once. This is for your safety.
- An IV is put into your hand or arm to provide fluids and medication. You may be given medication to help you relax.
- Anesthesia is given to prevent pain and make you sleep during the procedure. You may be relaxed and drowsy (conscious sedation) or in a state like deep sleep (general anesthesia).

Caring for Yourself at Home

- When you are ready to go home, have an adult family member or friend drive you.
- Take care of your incision and change the dressing as instructed. Check daily for signs of infection (see box below).
- You may be told to limit arm movement for a certain amount of time on the side where the device has been implanted. Your doctor will tell you more.
- In most cases, you can return to your normal routine soon after the procedure. You may even feel well enough to do things you couldn't do before the implantation. Talk with your doctor about how much activity and what types are okay.
- Many states have laws that limit driving for people with ICDs. If you have a biventricular ICD, talk to your doctor about the laws in your state.

Following Up

At first, you will have frequent follow-up visits. These will decrease over time. During the first few months:

- Your doctor will check your incision to be sure it's healing well.
- Your device may be reprogrammed (have its settings adjusted). Using test results, your doctor will find the best settings for your heart. See page 12 to learn more.
- Your symptoms may get better right away. Or, changes may be gradual. Talk with your doctor about any changes in how you feel.

When to Call Your Doctor

Call if you have any of these during the week after the procedure:

- **Signs of infection at the incision site, such as increasing redness, swelling, warmth, or drainage**
- **Fever of 100.4°F (38°C) or higher**
- **Pain around the device that gets worse, not better**
- **New or worsening heart failure symptoms**
- **Chest pain or shortness of breath**
- **Bleeding or severe swelling of the incision site**
- **Swelling in the arm or hand on the side of the device**
- **Twitching chest or abdominal muscles**
- **Frequent or constant hiccups**

Caring for Your Device

Your device must be checked a few times a year. If needed, the settings are adjusted. This helps ensure the device is working well. Rest assured, very few things can interfere with your device. However, there are a few precautions you should take.

Making Adjustments

During visits to your doctor or heart failure clinic, the settings on your device will be checked. Tests may be done to ensure the device is helping your heart as much as it can. At some visits, settings may be adjusted. This is done from outside the body. A computer called a programmer is used to read the device's memory and change settings as needed.

Checking the Battery

The battery level is checked during follow-up visits. Some biventricular devices have alarms that sound or vibrate when the battery is low. In any case, there is still plenty of time to replace the battery before it wears out. Most batteries in biventricular pacemakers and ICDs last several years. To replace the battery, the entire generator is replaced. This is done during a procedure that's usually simpler and shorter than the original implantation.

Most Outside Signals Are Safe

Biventricular pacemakers and ICDs are well protected. Most machines and devices will not cause problems. In the rare case that an outside signal does affect it, the device won't be damaged. The device may have an alarm that sounds or vibrates if a problem arises. If the alarm goes off or you ever suspect a problem, call your doctor.

What to Know About Outside Signals

Microwave ovens and other appliances should not cause problems. Neither should computers, hair dryers, power tools, radios, televisions, electric blankets, or riding in cars. But certain precautions are needed. To protect your ICD, follow the advice below.

- **A cellphone** will probably not affect the device. To be safe, carry a cellphone on the side opposite the device and at least 6 inches away from it.
- **Electromagnetic antitheft systems** are often near entrances or exits in stores. Walking through one is okay. However, avoid standing near or leaning against one.
- **Strong electrical fields** can be caused by radio transmitting towers and heavy-duty electrical equipment (such as arc welders). A running engine also produces an electrical field. Avoid leaning over the open hood of a running car.
- **Very strong magnets** should be avoided. They include big speakers (such as those at concerts) and in handheld security wands. Talk to your doctor before scheduling an MRI (a test that uses strong magnets).

While using a cellphone, hold the phone to the ear opposite your ICD or wear a headset.

Carry an ID Card

Always carry the ID card you are given that says you have a biventricular pacemaker or ICD. Show this card to any doctor, dentist, or other medical professional you visit. Also show it to guards who do security screening at the airport and in other places. Ask them not to use a handheld metal detector on you.

Staying Healthy

With CRT, you may be able to do more now than you could before. This makes it easier for you to stay active. Being active helps strengthen your heart and improves your health. Though you may feel better, continue following your heart failure treatment plan. Also ask about a cardiac rehab program and other ways you can help your heart.

Keeping Active

Your healthcare provider can help you form an activity plan that is right for you. Try these tips:

- Take a walk every day. Invite a family member or friend. If the weather is bad, try walking indoors, such as at a shopping mall.
- Biking, gardening, and swimming are other options that may work for you.
- Pace yourself. If you can't hold a conversation during activity, you may be pushing yourself too hard. Talk with your healthcare provider about the best level of activity for you.
- Even with CRT, you may still have some heart failure symptoms. Stop and rest if you feel tired or short of breath.

Signs of Overexertion

Stop exercising and call your doctor if you feel any of these symptoms:

- **Chest pain or discomfort**
- **Burning, tightness, heaviness, or pressure in your chest**
- **Unusual aching in your arm, shoulders, neck, jaw, or back**
- **Trouble catching your breath**
- **A racing or skipping heartbeat**
- **Extreme tiredness (especially after exercise)**
- **Lightheadedness, dizziness, or fainting**
- **Nausea**

Cardiac Rehabilitation

Cardiac rehabilitation (rehab) is a supervised, personal exercise program designed to improve your heart's health. This program often takes place at the hospital or another medical center. During cardiac rehab, you are shown how to exercise in ways that help your heart the most. Cardiac rehab teaches you how to eat well and gives tips for taking medications. It also provides emotional support and counseling. Ask your healthcare provider whether a cardiac rehab program might be right for you.

Your Heart Failure Treatment Plan

CRT is only one treatment for heart failure. You should still follow the rest of your treatment plan. This will likely include:

- **Dietary restrictions.** You will likely be told to limit salt (sodium). This helps reduce fluid buildup. Controlling fluid can make the heart's work easier and help control swelling. You may also be told to limit fluid intake or to follow other dietary restrictions. Your healthcare provider can help you learn what you need to do.
- **Medications.** With CRT, you may have fewer side effects from medications. So, your doctor may be able to change your medications or dosages to help manage your heart failure better. Take all medications as prescribed by your doctor.
- **Weight monitoring.** Rapid weight gain can be a sign that fluid is backing up in your body. This may mean your treatment plan needs to be changed. To monitor your weight, weigh yourself at the same time every morning, wearing the same clothes. Do this after urinating and before eating. *Call your healthcare provider if* you gain more than 2 pounds in 1 day or more than 5 pounds in 1 week. If you receive other instructions for reporting weight gain, follow them as directed.
- **Other steps to improve your health.** Your healthcare provider may help you develop a plan to quit smoking, lose excess weight, or lower your blood pressure. Talk with your doctor or rehab team about steps you can take to help your heart.

Work with Your Healthcare Team

CRT may help you have more energy and feel better overall. But you still need to take your medications, follow any food or drink restrictions you're given, and keep an eye on your symptoms. Most importantly, work closely with your healthcare team. If you have questions about CRT or any part of your treatment plan, be sure to ask them. Also keep your appointments. This will help ensure that you and your heart get the best care possible.

Also available in Spanish

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